Initial conditions for the ^{10}Be marker experiment in JET with ITER-like wall

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The recently initiated ITER-like wall operations at JET aim at gaining experience and improved understanding of plasma-surface interactions in a big tokamak with beryllium wall in the main chamber and tungsten surfaces in the divertor. Many key issues, such as component life times, tritium inventory, dust production and tungsten impurity release, are associated with the erosion of Be in the main chamber, followed by redepostion and migration of eroded material, both in the main chamber and in the divertor. In order to study this Be migration, an experiment with ^{10}Be marker is in progress. Three inner wall guard limiter (IWGL) tile pieces, in octant 5Z just above the horizontal mid plane, have been enriched with ^{10}Be before insertion in JET. The marker pieces were uniformly doped with ^{10}Be through irradiation with thermal neutrons. The isotopic concentration ratio in the primary source has been determined with accelerator mass spectrometry (AMS) to be ^{10}Be / ^{9}Be=$1.73\cdot10^{-9}$. The background level of ^{10}Be in JET wall material, as well as in Be-containing samples that have been exposed to the neutron flux in JET through extended previous operations, has been shown to be ^{10}Be / ^{9}Be < 10^{-14}, which can be considered as the practical sensitivity limit for measurements of the ^{10}Be concentration at plasma facing surfaces that can be extracted for post-mortem analysis during future JET shut downs.
The isotopic analysis process includes dissolving either entire deposited layers, or surface layers removed from bulk Be samples by mechanical sectioning with a depth resolution of about 10 µm. The samples are then diluted with pure ^{9}Be carrier if necessary, ionized and passed through a tandem accelerator so that single atoms can be mass analyzed and counted. The implications for sensitivity and interpretation of the experiment are discussed.
A preliminary analysis of where the marker is expected to go from the primary source is made based on the field line geometry in the scrape-off layer (SOL) in representative discharge configurations, and assuming small perpendicular transport in the SOL. The aim of the experiment is to be comparable with numerical codes that exist and/or are being developed for modeling the materials migration, such as WALLDYN [1], ERO/3D-GAPS [2] and ASCOT [3].

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